

Impact of Environmental Legislation on European Space Sector - an ESA View

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1. Introduction to ESA
2. REACH
 - a. Background
 - b. Risks
3. Major identified risks
 - a. Legal aspects
 - b. Technical aspects
 - c. Standardisation
 - d. Communication
4. ESA workplan
5. Conclusions

Mission of Materials and Components Technology Division

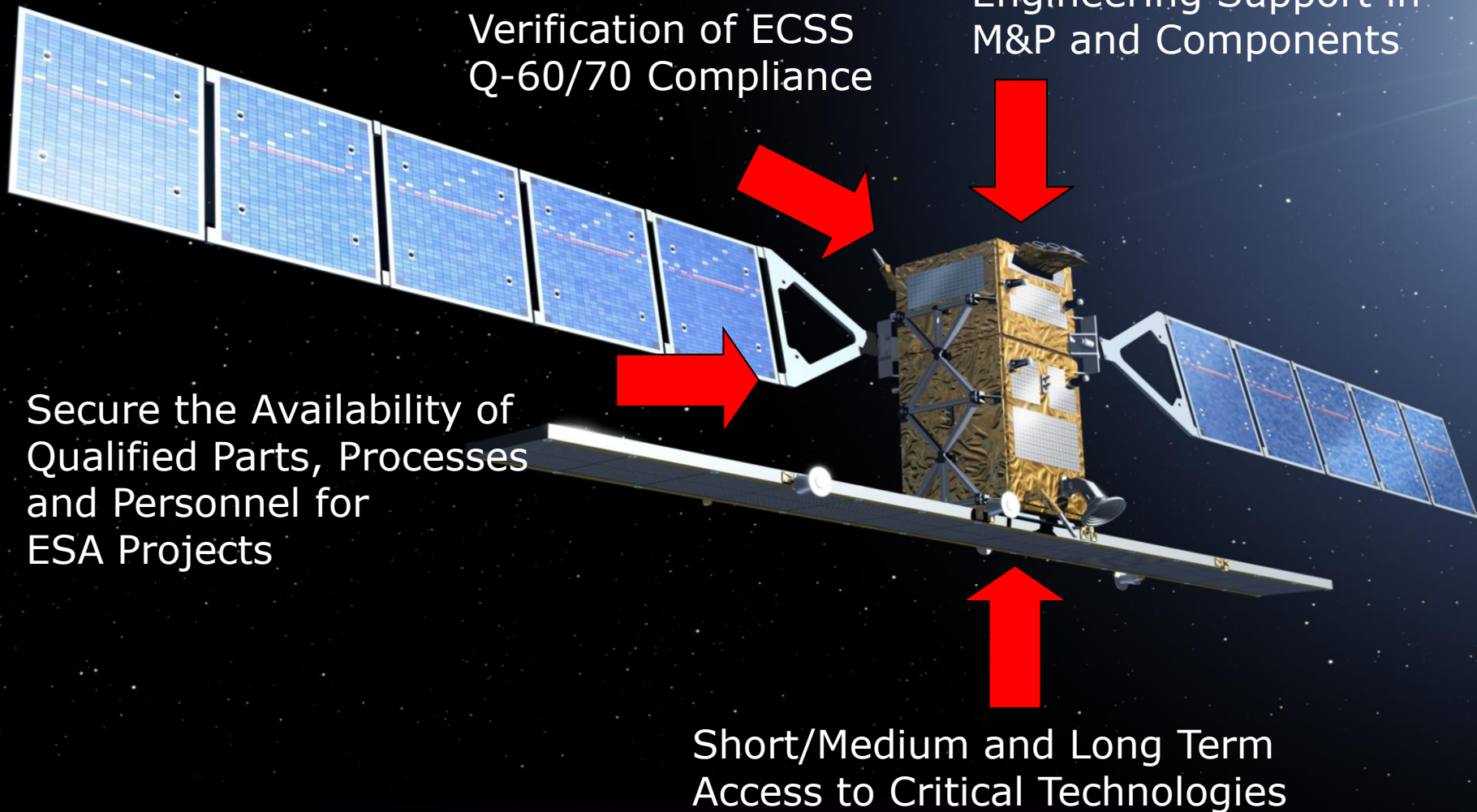


Verification of ECSS
Q-60/70 Compliance

Engineering Support in
M&P and Components

Secure the Availability of
Qualified Parts, Processes
and Personnel for
ESA Projects

Short/Medium and Long Term
Access to Critical Technologies



European Space Agency (ESA)

Intergovernmental European organization dedicated to the exploration of space

Currently 19 member states, 1 associated member, and 11 cooperation agreements at various levels

Annual budget 2011 about 3500 M€

Space activities in the area of

- Space science
- Human spaceflight
- Exploration
- Earth observation
- Launchers
- Navigation
- Telecommunications
- Technology
- Operations





Vertical directorates related to ESA programs

- D/EOP Earth Observation
- D/HSO Human Spaceflight and Operations
- D/LAU Launchers
- D/NAV Galileo Program and Navigation
- D/SRE Science and Robotic Exploration
- D/TIA Telecommunications and Integrated Applications

Horizontal directorates provide functional support to the whole organisation

- D/CR Corporate Reforms
- D/PFL Procurement, Financial Operations and Legal Affairs
- D/PPC Policies, Planning and Control
- D/TEC Technical and Quality Management

Majority of activities are conducted by industry.

REACH¹ applies to all chemicals imported or manufactured in the European Economic Area (EU + NOR, ISL, LIE)². It shifts the responsibility for demonstration of safe use of chemicals from authorities to industry. The manufacturing, placing on the market and use of substances in Europe is regulated by processes through:

- Registration
- Authorisation
- Restriction

The candidate list, the baseline tool to identify substances as SVHC³, lists currently 53 entries. By 2020 it is expected to contain 300 – 400 substances.

SVHCs are gradually included in the Annex XIV of the REACH regulation. Once included in that annex, they cannot be placed on the market or used after a date to be set (the so-called 'sunset' date) unless an authorisation is granted. All uses not authorised have to be phased out.

¹ EU Regulation 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH)

² Note: EU member states ≠ ESA member states, e.g. CH

³ Substance of Very High Concern based on hazardous assessment

The large number of substances requiring authorisation as well as the strict rules and high costs involved to seek authorisation will consequently lead to disappearance of substances from the market. It is estimated that industry may be forced to phase out substances within 4.5 – 6 years once a proposal for SVHC classification has been initiated.

- Timeframe is easily within the development schedule of a satellite project
- Control of the obsolescence risk is vital to avoid costly re-qualification of materials and technologies when discovered in a late stage.
- Require a very comprehensive long-term risk assessment to guarantee uninterrupted supply of qualified materials and technologies over the life-time of the program.

Most imminent risk is the possible future obsolescence of materials. Many manufacturers are expected to

(i) phase out materials or

(ii) alter the composition of materials

in case they contain SVHC constituents or if the costs of registration and authorisation are considered too high.

The change of legislation has an impact on the corporate profile of ESA

- **Legislative aspects**

May lead to unforeseen liabilities

→ increased CaC

- **Technical aspects**

May lead to unforeseen obsolescence

→ increased CaC, schedule delay

- **Standardisation**

May lead to incomplete communication of PA requirements through supply chain

→ increased CaC, schedule delay

- **Communication**

Various ESA programs may have a different strategy to tackle REACH

→ Inefficient use of ESA resources

The REACH regulation may impose certain liabilities on ESA depending on its role in the procurement chain. Obligations of ESA are based on its role in the procurement chain (manufacturer, importer or downstream user) for the different business models. Examples include:

- Satellite platforms with payloads provided by European or non-European third parties
- ESA as satellite procurement agent for a third party
- Purchase of launch services
- Research and Development contracts

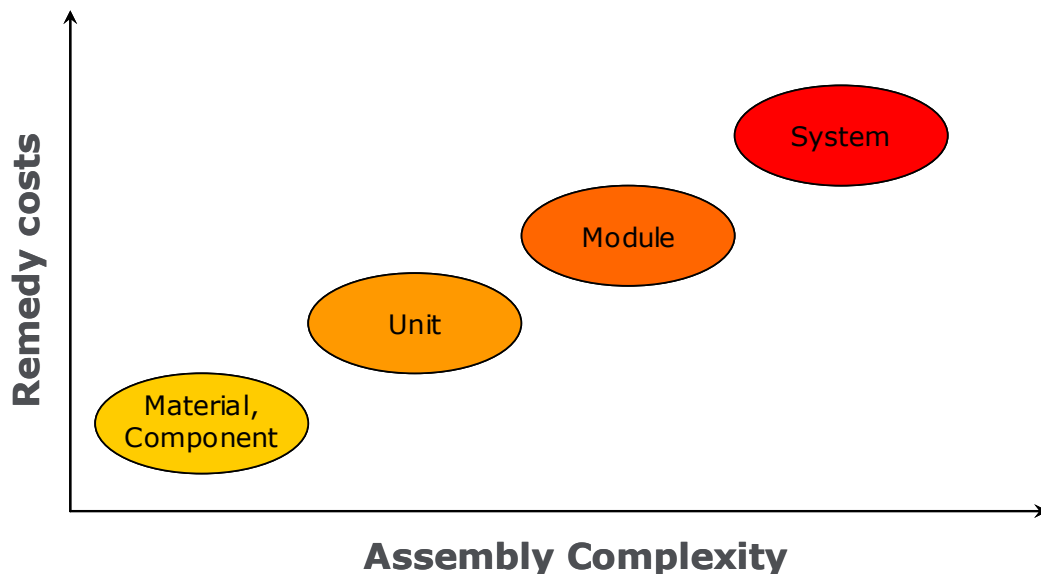
Mapping of various ESA roles has been completed and contract clauses are to be modified accordingly.

Precautions need to be taken in particular when ESA acts as importer of a payload coming from outside the EEA. This means special attention needs to be devoted to items imported in the EU from Switzerland (ESA member) and Canada (ESA participating state).

Possible obsolescence of qualified materials and processes:

- Change in materials/substances compositions
- Alterations of manufacturing processes
- Removal of materials/substances from the European market
- Unanticipated risks, *e.g.* missing of deadlines for registration

Very long life-cycles (e.g. launchers 20-30 years, satellite constellations) → need to actively manage the risk (cost trade-off)



Obsolescence becomes a major issue with REACH, and requires appropriate management.

Obsolescence of Materials, Processes and Technologies



Observatory group on a European-wide platform has been established involving, national space agencies, industry, and ESA with the objectives to:

- Identify in advance potential critical materials and processes for satellite platforms and launchers.
- Reduce programmatic risks and costs by early replacement, including use of alternatives, re-qualification or possibly new developments.
- Perform a risk assessment of identified materials and processes taking into account the status in the REACH process, diversity of uses, availability of alternatives, *etc.*
- Propose corrective actions that may include
 - Use of already qualified or qualification of alternatives
 - Development of alternatives
 - Authorisation for space-related applications
 - Exemption from REACH regulation for space industry (if legally applicable)

High Obsolescence Risk Items – Current Snapshot



Issue	Status	Implications	Timeline	Corrective actions
Hydrazine (propellant)	Has been included in candidate list on 20 June 2011. Not yet prioritised for Annex XIV inclusion (earliest mid 2012).	Strategic for space programs Disruption in hydrazine supply will compromise Europe's autonomy to access space, and weaken the strategic position as well as competitiveness of the European space industry.	Enters Annex XIV earliest by 2014	Promote development of alternatives via ESA R&D funding schemes. Exemption Authorisation
Hexavalent chromium (corrosion protection, primers)	Family of chromates already on candidate list. They are expected to be part of the 3 rd Annex XIV recommendations in 2011.	Affects Alodine 1200 S ('working horse' for corrosion protection), BR 127 (widely used structural primer), and anodisation processes. Qualified alternatives must be available by 2016.	Enters Annex XIV probably late 2012. The sunset date (use only if authorised) is expected by 2016.	Support industry-wide qualification of alternatives. Technical collaboration with NASA in finding alternatives. Possibly authorisation.
Solvents (cleaning or process media)	Limited not only by REACH but also (inter)national environmental regulations	Cleaning or other process require alternatives. Affects e.g. chloro and fluorochloro solvents.	Continuous	Support industry-wide qualification of alternatives.
GaAs, InP (EEE RF components, solar cells)	High probability to be classified SVHC after previous ECHA public consultation for hazardous classification.	Strategic for space programs (solar cells, RF-applications) Likely to enter the roadmap towards authorisation list. No full alternative is expected in mid/long term, risk of compromising European non-dependence.	Not yet on authorisation process.	Coordinate industry inputs for ECHA public consultations. Promote development of alternatives. Authorisation
Arsenic oxide (GaAs wafer production)	Recommended by ECHA for inclusion in Annex XIV since 17 Dec 2010.	Required pre-cursor for GaAs wafer production.	Enters Annex XIV probably by early 2012.	Authorisation
Other strategic materials (General space segment)	Identification of risk items with industry ongoing.	Dramatic costs and programmatic risks in case of supply chain disruptions	Continuous	Pro-active initiatives on technical, programmatic and political level.

Alert level among high-risk items	
High	Strategic, no alternative available in mid/long-term, regulatory risk imminent
Medium	Widespread use, potential alternatives on the market, regulatory risk imminent
Low	Widespread use, large non-space use, regulatory risk mid/long term
Unrated	Not yet identified risk

The REACH regulation may impose certain implication in management and technical procedures, *i.e.* mainly effecting the management, engineering and quality series of ECSS. The objective is to pass REACH associated requirements through the supply chain.

- Examples for technical standard

Use of solvents (*e.g.* chloroform) or chemical substances (*e.g.* phthalates) in procedures (ECSS-Q-ST-70-05C 'Space product assurance - Detection of organic contamination of surfaces by infrared spectroscopy')

- Example for management standard

Obsolescence management standard: Best practices from 'terrestrial' industry transferred to ECSS standard.

Information exchange is relevant at several layers to reach all relevant stakeholders:

- Internal: Establishment of information platform to create awareness among ESA programs on REACH
- External (industry): Establishment of common database to reflect the 'REACH status' of materials and processes, accessible for all ESA members, continuation of European observatory group
- External (political): Decisions during the evaluation period as well as on possible authorisation and exemption are made by the European Commission. Communication on political level between ESA and EC is considered necessary to support these processes, especially for strategic high risk items.
- Dialog with ESA members that are non-EEA countries (Switzerland, Canada)
- International: Exploit synergies with international partners such as NASA and JAXA

Summary of Major Identified Risks

Issue	ESA Concern	Status	Risk mitigation
Obsolescence of Materials, Processes and Technologies Risks to ESA Programmes	Due to more stringent legislation, suppliers may phase out or change formulations of materials used in ESA Projects leading to costly re-qualification with schedule and cost impact.	Proactive approach to identify potential risks as early as possible: Mapping of the industrial exposure to REACH with the industry and CNES on-going. Approx. 1500 common materials screened and entered to a shared database for continuous surveillance.	Based on the mapping of the industrial exposure a risk matrix is established, for high risk substances, the following corrective actions shall be considered: 1. Early re-qualification 2. REACH exemption 3. REACH authorisation
Potential ESA legal and contractual liabilities	Unexpected legal or contractual liabilities related to legislation pushed from the industry to ESA.	Identification of ESA liabilities depending on its role in the procurement chain. Legal mapping of various ESA scenarios completed.	Formulation of contract clauses towards 'zero ESA liability' related to environmental legislation.
Standardisation	Lack of proper coverage and flow-down of obsolescence, materials & process management practices in the industrial supply chains of ESA.	Identification of implications to ECSS Q, M and E series on-going.	Proposal of new working items or change requests to ECSS secretariat.
Communication	Slow information exchange and lack of relevant information within ESA related to REACH/RoHS leading to potentially different working practices. Lack of coordination and with all relevant stakeholders including industry and EC.	Establishment of Intranet website on-going to increase awareness. Active collaboration and industry support through CTB working group. Identification of communication channels between ESA and EC.	Establishment of intranet website + recognised organisational structure to manage REACH/RoHS. Continuation of CTB working group Communication between ESA and EC.

REACH is for ESA not only a compliance issue but needs to be addressed in the context of R&D.

ESA efforts on 'Green technologies' will be increased in order to be able to face the new challenges coming from:

- New legislation leading to obsolescence, increase cost of processes/materials
- Intelligent use of resources (evaluation of energy use, as well as, the use of rare metals)
- Increased public interest in protecting the environment

ESA will be proposing a special work plan to be implemented in the technology development programs and in coordination with national programs.

The workplan consists of two elements

- Acceleration of R&D for green alternatives
- Requalification of alternative materials that face obsolescence

- Permanent ESA management structure for establishing an early warning system and manage corrective actions (with industry and national space agencies) that prevents future supply disruptions.
- Continuation of industrial observatory for periodic quantification of obsolescence risk, placement of corrective actions to support qualification or the development of new alternative solutions with industry and space agencies
- Qualification of alternative materials, processes, or technologies. Cooperation on European and international level is envisaged to exploit synergies.
- Information exchange is relevant at several layers (internal, external, international) to reach all relevant stakeholders.
- Establishment of R&D budget for qualification and development of alternative materials, processes, or technologies.